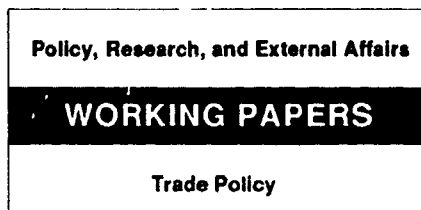


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Do Wage Distortions Justify Protection in the U.S. Auto and Steel Industries?

Jaime de Melo
and
David Tarr

No. Wage premiums in those industries may even exacerbate the welfare costs of protection.



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This paper — a product of the Trade Policy Division, Country Economics Department — is part of a larger PRE research effort to understand the effects of trade policy on industrial efficiency. Copies of the paper (or of an appendix describing the model) are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Sheila Fallon, room N10-017, extension 37947 (32 pages).

De Melo and Tarr examine the welfare effects of protection in two high-wage sectors — autos and steel — to determine if protection is justified to correct for the misallocation of labor necessitated by wage distortions.

But de Melo and Tarr argue that because of union influence, the wage premium is endogenous in the auto and steel industry — so wage premiums may even exacerbate the welfare costs of protection.

If wage premiums are exogenous, under most product market structures labor misallocation is too small to justify protection.

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This paper is part of research on trade policy and industrial efficiency at the World Bank. An appendix describing the model is available from the authors upon request. We thank Tom Rutherford, Glen Harrison, Shantayan Devarajan, and Susan Vroman for helpful comments, and Ghislaine Bayard, Alex Pfaff, and Rebecca Sugui for excellent logistic support.

1. Introduction

Recent empirical work, which has adjusted for sex, age, full time work, fringe benefits and other available worker characteristics, has estimated inter-industry wage differences in the United States (US). The conclusion is that it is difficult to account for remaining persistent inter-industry wage differentials on the basis of unobserved differences in ability or equalizing differences such as attractiveness of the work. Rather, it appears that workers in a number of industries earn rents (Krueger and Summers, 1988; Katz and Summers, 1989b). These wage differentials are often explained on the basis of "efficiency" wage theories,^{1/} and, in the cases more relevant to this paper, on the basis of union extraction of rents. Since firms presumably employ workers up to the point where the value of the workers' marginal product equals the industry wage, these data imply that the value of the marginal product of workers in wage premia industries exceeds the value of the marginal product of workers in industries without wage premia. It follows that labor is misallocated in the economy, with too little labor employed in sectors that pay wage premia.

Some authors (e.g., Katz and Summers, 1989a, 1989b) contend that these factors form the basis for a theory of industrial policy which is more relevant empirically than product market imperfections along the lines pioneered by Brander and Spencer (1983, 1984), i.e., there is little opportunity for international profit-shifting compared with situations where industrial policy can reallocate labor efficiently.^{2/} The argument is that, given the existence of wage distortions, we are in a second best world where the provision of an export subsidy or import tariff to a wage premia sector may be socially beneficial if the conventional production and consumption distortion costs of

tariffs or subsidies are outweighed by the reduction of labor misallocation costs. To date, however, the argument has not been subjected to any empirical test.

Two industries where wage premia are among the highest and which have recently received import protection are autos and steel. In addition to the existence of wage premia and protection, these industries were chosen because of the existence of significant increasing returns to scale which implies that market structure issues may also be relevant to the conclusion. In this paper we investigate systematically the empirical validity of the wage distortion argument as a basis for protection with a general equilibrium model of the US economy in these industries. The model is calibrated to 1984, a year in which VERs on Japanese auto imports were binding and VERs on steel imports had just been negotiated. We estimate the costs of protection in autos and steel with and without wage premia under three different market structures: constant returns to scale (CRTS) and perfect competition; increasing returns to scale (IRTS) and contestable markets; and IRTS and monopolistic competition.

We show that if the wage premia are exogenous, the costs of protection are less than if there were no premia, but not significantly so. Under all market structures, the benefits of superior labor reallocation are far too small to justify the protection provided. However, we argue that wage distortions in autos and steel are more reasonably modelled as the result of union exploitation of monopoly power and therefore should be endogenous where the union has a tradeoff between employment and the wage premium. With endogenous wage premia, the imposition of protection will increase the wage distortion. This reduces the second best effect of labor misallocation, so the costs of protection are closer to the case of no wage premia.^{3/} Moreover, if the union values the wage premium sufficiently highly relative to an increase

in employment, the costs of protection may be greater than in the case with no wage distortions.

This latter result bears resemblance to the discussion by Eaton and Grossman (1986) who argue that one must be cautious in using profit-shifting as a basis for industrial policy because the existence of profits could be the basis for taxing rather than subsidizing an industry. The appropriate policy depends on how firms formulate expectations, something about which policy-makers have little information. In a similar vein, we find that wage premia may result in higher costs of protection depending on the union's valuation of wages versus employment. More strikingly, we show that the "optimal" wage policy is a tax under IRTS and a market structure which allows for firm entry and exit. In sum, we show that once one recognizes the endogeneity of wage distortions, it becomes difficult to determine appropriate industrial policy on their basis and extra caution must be exercised under IRTS.

In terms of modelling innovation, this paper is the first to model endogenous union-induced labor market distortions in applied general equilibrium. It is also the first to investigate systematically the impact of labor market distortions under different market structure assumptions. Also in line with our focus on the labor market and the interaction of employment and wage distortions, we incorporate labor-leisure choice in a more satisfactory manner than previously.

The remainder of the paper is organized as follows. In section 2, we describe how we model labor market distortions with and without labor union activity. We also describe how we model economies of scale and how we represent pricing practices. Section 3 describes the data and benchmarking for the counterfactual simulations and reports on the welfare costs of VERs under CRTS and no wage distortions. Section 4 evaluates the distortionary costs of

protection created by the VERs both with and without labor market distortions and, with and without imperfectly competitive behavior. This step-by-step approach helps isolate the contribution of each distortionary component. Section 5 asks what would be the likely benefits of optimal wage and tariff policies in the auto and steel industries. Conclusions follow in section 6.

2. Modelling Labor and Product Markets in Autos and Steel

The auto and steel sectors are among the sectors that pay the highest wages in US manufacturing. Steel worker (auto worker) compensation was 63 (53) percent above the compensation of the average US manufacturing worker in 1984.^{4/} Using the 1984 Current Population Survey, Krueger and Summers (1988) estimate that, after controlling for human capital and demographic factors such as sex, age, race, marital state and education, workers in the transport equipment sector earn a premium of 27 percent above the industrywide average, and workers of fabricated metal a premium of 26 percent. They also find that these statistically significant premia are stable across time and space. These wage premia are viewed as too large and persistent to be explained by compensating differentials such as attractiveness of work. Similar results were found by Katz and Summers (1989b).

In view of this (and other) evidence, we assume that workers in auto and steel earn a premium. We model this premium in two different ways. In one variant, we assume that the premium is exogenous $\phi_i > 1$, i.e. $W_i = W\phi_i$, where W is the wage earned in sectors where workers do not receive rents. Workers in all industries receive the value of their marginal product at the wage rate $W\phi_i$. Since $\phi_i > 1$ is a premium, we choose $\phi = 1$ for all sectors other than

autos and steel.^{5/} This places us in a typical second-best situation since the benefits of removing protection in autos and steel must now be balanced against the costs of taking labor out of these sectors where the value of the marginal product of labor is relatively high.

In the other variant, we model the determination of the wage premium. Katz and Summers (1989a) have noted that steel and autos are an exception to the pattern of high wage industries in that exports are not significant and that the high wages do not appear to be explained by efficiency wage theories. Rather, strong union behavior appears to explain the high wages. In this set-up, unions are viewed as an instrument of employees to generate (or extract) monopoly rents. These rents can exist due to regulation or imperfections in the product market. If the union can organize a sufficiently large percentage of workers in the industry, it can then restrict labor supply and collect these rents in classic monopoly fashion. When the conditions which lead to the generation of the rents change, the premium earned by workers will change. Hence the premium earned by workers is endogenous with respect to a change in protection.^{6/}

In this variant, we assume that the union either unilaterally sets the wage rate or negotiates it with the firm, but that the firm unilaterally determines the level of employment. It is well known (see McDonald and Solow, 1981) that allowing unilateral determination of the employment level by the firm results in outcomes off the union-firm contract curve in wage-employment space. We choose our assumption, however, because the evidence indicates that firms and unions are not on their contract curve (Farber, 1986).^{7/}

The union's utility function is given by (sector subscripts for autos and steel dropped):

$$(1) \quad U = \bar{A} [W\phi - \bar{W}_0]^\gamma [L - \bar{L}_0]^\delta ; \bar{A}, \gamma, \delta > 0$$

where W is the wage rate in the competitive labor market (i.e., in other sectors) γ, δ are parameters determining the weights attached to wages and employment, and \bar{W}_0, \bar{L}_0 are the minimum acceptable levels of the wage rate and employment. The formulation follows Farber (1986).^{8/} It is natural to take $\bar{W}_0 = W$. For the CES technology for value-added assumed here, labor demand, L^d , is given by:

$$(2) \quad L^d = \left(\alpha \frac{PVC}{W\phi} \right)^\sigma (X/\bar{A})^{1-\sigma}$$

where \bar{A} is a constant, PVC is primary variable cost, σ is the elasticity of substitution between capital and labor, α is a quasi-share parameter for labor from the CES value-added function, and X is output. The union maximizes (1) subject to (2), yielding the following expression for the endogenous wage differential:

$$(3) \quad \frac{\phi - 1}{\phi} = \left(\frac{L^d - \bar{L}_0}{L^d} \right) \frac{\gamma}{\delta\sigma}$$

Thus, since labor is a derived demand, the wage differential will be affected by changes in trade policy.

In this formulation, high (low) values for γ combined with low (high) values for δ correspond to cases where the union puts a high (low) weight on wages (employment). The evidence suggests that union behavior departs from the special cases of rent maximization or wage bill maximization (see Farber, 1986 for a survey). Hence, we shall vary systematically the weights of the union's objective function to account for a range of plausible behavior.

By assuming a passive firm, we may be attributing the impact of a non-passive firm (which would lower the wage and increase employment) to union preferences for more employment. For labor economists interested in explaining union behavior, the distinction between an active and a passive firm is crucial, but for our objective of approximating wage and employment levels in the steel and auto industries in response to a change in trade policy, this simplification is a natural one. This is because increasing the weight on employment in (1) is equivalent in terms of the wage-employment outcome to the firm non-passively influencing the wage decision with a lower employment weight. What is crucial for the debate on trade and industrial policy is that this formulation allows for trade policy to influence the degree of distortion in the labor market. As an example, consider a decrease in the level of protection in the auto industry. This will induce an inward shift in the demand curve for labor as consumers shift towards imported autos. This inward shift, in turn, will induce the union to set a lower wage (i.e., to choose a lower ϕ).

Economywide labor supply is endogenous since the representative consumer-worker maximizes the extended nested Stone-Geary utility function:

$$(4) \quad W = \prod_{i=0}^n (C_i - \lambda_i)^{\beta_i}$$

where $\sum_{i=0}^n \beta_i = 1$, $\beta_i > 0$, $(C_i - \lambda_i) > 0$, C_0 is leisure, $i = 1, \dots, n$ is an

index over composite commodities. Utility maximization takes place in two stages. In the first stage, as in Abbott and Ashenfelter (1976), maximization of (4) subject to "full income" yields the labor supply equation:

$$(5) \quad LS = \overline{MAXHOURS} - (\beta_0 / W) (Y - \sum_{i=1}^n P_i \lambda_i) / (1 - \beta_0)$$

where Y is income, W is the wage rate, $\overline{MAXHOURS}$ is a parameter denoting the maximum workforce, and P_i and λ_i may be interpreted as the price and minimum subsistence of the composite good of sector i, respectively. In the second stage, the consumer maximizes composite consumption C_i subject to income allocated to consumption of goods in sector i. This formulation of the utility function allows us to calibrate labor supply and commodity price elasticities.^{9/} Based on a review of the econometric evidence, we calibrate (5) to an elasticity of supply of labor to income of -0.12 and an elasticity of labor supply to the real wage of 0.055.^{10/}

The main focus of this paper is on the costs of trade restrictions in the presence of labor market distortions. Therefore, we consider first the effects of the costs of protection in both sectors under the assumption of perfect competition and a CRTS technology. However, there is evidence of unexploited economies of scale in both sectors.^{11/} Hence the alternative of an IRTS technology and the need to decide on the appropriate pricing rule.

For pricing, we assume that US steel and auto firms price competitively in export markets because they face close substitutes from stiff foreign competition. The assumption is plausible and, in any case, of little consequence for both industries where exports do not exceed 5 percent of total sales.

With respect to domestic sales, the evidence in steel strongly suggests the absence of monopolistic pricing practices in the last 25 years (see, e.g., Scherer (1980), Tarr (1990), US Federal Trade Commission (1977), Rippe (1970), or Mancke (1968)). Hence we assume an analogue to marginal cost

pricing under CRTS, namely contestable market pricing. Under this assumption, threat of entry (because of ease of entry) forces firms to price at average cost.

For autos, a model with imperfectly competitive pricing may be more appropriate. For example, Dixit (1988) calibrates conjectures and finds evidence that the auto industry prices between competition and Cournot. Therefore, for autos we contrast contestable market pricing with the alternative of monopolistic competition with calibrated conjectures and free entry. Denote then by ϵ^d the market elasticity of demand of the domestic variety for autos with respect to the domestic price (an endogenous variable that depends on elasticities and shares of all sectors--see de Melo and Tarr (1990b)). Then, in equilibrium, the price PD_i charged by each firm i for domestic sales is given by:

$$(6) \quad \frac{PD_i - MC_i}{PD_i} = \frac{\tilde{\eta}}{N\epsilon^d}$$

where N is the number of domestic firms and $\tilde{\eta}$ is the output conjecture of the i -th firm, i.e. the amount by which the i -th firm assumes industry output will change in response to a small unit change in its own output. Equation (6) defines the percentage mark-up over marginal costs in terms of N , ϵ^d and $\tilde{\eta}$.^{12/} It can be rewritten to state that each (symmetric) firm sets marginal revenue equal to marginal costs MC_i . Given an initial value of N and ϵ^d , $\tilde{\eta}$ is calibrated from (6). The values of ϵ^d and $\tilde{\eta}$ appear in table 1 along with other relevant information on the auto and steel sectors. Like Dixit, we find conjectures more competitive than Cournot.^{13/} In the simulations, the value of N is endogenously determined so that the long-run zero profit condition is maintained by entry/exit.

Table 1

Distortions, Production, Demand Structure, and Elasticities
in the Auto and Steel Industries

	Autos	Steel
<u>Distortions</u>		
Wage Premium (ϕ)	27.0	26.0
Premium Rate on Imports	31.8	7.0 <u>b/</u>
<u>Production and Demand a/</u>		
Gross Output	124.2	57.5
Employment (1,000 man-years)	536.5	531.0
Domestic Final Demand Sales	111.0	0.0
Intermediate Sales	8.3	56.1
Exports	4.9	1.4
Imports		
Intermediates	2.3	12.7
Final Demand	30.3	0.0
<u>Elasticities and Parameters c/</u>		
Capital-Labor Substitution	0.8	1.0
Import-Domestic Substitution Elasticity <u>d/</u>	1.9	3.0
Composite Final Demand	0.8	n.a.
Export-Domestic Transformation Elasticity <u>d/</u>	2.9	2.9
Calibrated Conjecture ($\tilde{\alpha}$)	0.72	n.a.
Derived Elasticity of Demand (ϵ^d)	1.37	n.a.
Cost Disadvantage Ratio (CDR)	0.11	0.04

Notes: n.a. = not applicable.

a/ 1984 US \$ billion.

b/ Premium rate resulting from rationing steel to 85 percent of the volume of steel imports in 1984.

c/ The sources for demand and supply price elasticities are detailed in de Melo and Tarr (1990b).

d/ The selected CES (CET) functions imply that the corresponding substitution (transformation) elasticities are compensated import demand (export supply) price elasticities.

We assume perfect substitution across for all firms' products within a sector. To avoid specialization that would occur in response to changes in trade policy if domestic and foreign goods were perfect substitutes, we assume national production differentiation at the sector level. Foreign produced goods are imperfect substitutes for domestically produced goods, and goods sold abroad are imperfect substitutes with goods sold on the domestic market.

(Constant elasticities of substitution and transformation, respectively.)^{14/}

This assumption implies that we do not model variety so that entry results in market fragmentation. But, as suggested by Dixit and Stiglitz (1977), increased product variety raises welfare. Thus, firm exit (the mechanism by which zero profit is achieved under monopolistic competition) may overstate the benefits of removing protection unless additional import varieties are obtained.

The remaining features of the model are standard to computable general equilibrium (CGE) models. The model includes two factors, capital and labor which are mobile between sectors. Total capital is in fixed supply. Domestic demand includes two components, final and intermediates. The government sector's role is limited to lump-sum redistributions to and from the representative consumer. In the simulations reported below, the static CGE model is disaggregated into 10 sectors, among which are autos and steel. The model is calibrated to 1984, a year when the VER on Japanese autos was particularly binding and the year in which the US Trade Representative negotiated VERs with foreign governments with the stated objective of inducing a reduction in the imports of carbon and alloy steel products to 18.5 percent of domestic apparent consumption down from the 26.4 percent level of 1984. In practice the VERs in steel were not so binding, so we assume they induced a 15 percent reduction in imports rather than the 30 percent reduction intended by

the negotiations. All simulations maintain tariffs at their existing level in 1984 (an economywide average of 3.5 percent) as well as quotas in textiles and apparel negotiated under the Multi-Fiber Agreement (MFA).

3. Costs of VERs Under CRTS and No Wage Distortions

We start with a "traditional" welfare cost calculation of VERs in autos and steel. We assume perfect competition with a CRTS technology and a labor market where the auto and steel sectors do not pay a wage premium. We decompose the costs of protection into distortionary and rent components and check the sensitivity of results to the specification of labor supply. When we introduce product and labor market "imperfections" in section 4, we shall concentrate mostly on the evaluation of the distortionary cost component. Also, in section 4, all results will refer to the specification with endogenous labor supply.

Table 1 describes the structure of the auto and steel industries and the estimated distortions in both sectors. The source of the wage premia have been discussed above. The estimated premium rate on auto imports for 1984 is estimated at 31.8 percent. As discussed in de Melo and Tarr (1990a), this rate combines the estimates by Feenstra (1988) (for Japanese premia) and Dinopoulos and Kreinin (1988) (for European premia). Both studies have used hedonic regressions to adjust for quality changes induced by the VER. The premia go predominantly to foreigners, in this case Japanese and European auto producers.^{15/} Simulating the costs of the VER on Japanese auto imports can therefore be decomposed into two components: a rent component that would arise if the US were to capture premia; and a distortionary cost component arising from the wedge created by the premium. For steel, the costs of protection also

has the same two components, but the simulation is obtained by solving the model for a restriction in the quantity of steel imports which yields a premium rate of 7 percent on steel imports.^{16/} Hence, there is asymmetry in the way the costs of protection are simulated in each sector. For simplicity, we report all welfare estimates (given by the Hicksian equivalent variation measure) as positive numbers.

Apart from these distortionary measures, table 1 gives information on the production and demand structures in both sectors. Both sectors exported a very small share of total production and faced stiff competition from imports in 1984, at least as measured by import penetration ratios. Gross output of steel was about half that of autos and is the more labor-intensive of the two sectors. Elasticities of substitution in demand (between imports and domestic) are higher in steel than in autos, reflecting the characteristics of a more homogenous product.

Welfare and employment effects of the VERs are given in table 2. To maintain symmetry in the table, we present all results as if VERs are imposed in both sectors. The welfare cost of VERs on autos is higher than on steel, because the import value of autos is about 2.5 times higher than the import value of steel products, and autos is the more distorted of the two sectors with a premium rate about 4.5 times that of steel.^{17/}

The welfare costs of protection are almost identical between fixed and variable labor supply. However, variable labor supply would affect welfare results in simulations imposing a tax on wages (see Ballard et al. 1985, chapter 10). The change in employment in autos, however, does differ slightly between fixed and endogenous total labor supply. Removing protection in autos results in increased income, which reduces aggregate labor supply and the

Table 2
Welfare Costs of Imposing VERs in Autos and Steel:
CRTS and No Wage Premia

(in billions of 1984 dollars)

	Fixed Total Labor Supply		Endogenous Total Labor Supply	
	<u>Autos</u>	<u>Steel</u>	<u>Autos</u>	<u>Steel</u>
Rent Capture <u>a/</u>	7.877	0.736	7.867	0.736
Distortionary Costs <u>a/</u>	1.939	0.128	1.998	0.128
Total Costs <u>a/</u>	9.816	0.864	9.815	0.864
Employment Change <u>b/</u>	36.22	20.80	36.24	20.80

Notes:

a/ Welfare costs given by the equivalent variation (EV) measure.

b/ Change in employment in the sector in thousand work-years.

reduction is distributed across all sectors including autos. Given our focus on the labor market effects of protection, all remaining simulations assume an endogenous total labor supply. Also, most of our discussion will focus on the distortionary cost component of VERs.

4. Distortionary Costs of Protection with Labor and Product Market Imperfections

We now come to the central issue: are labor market imperfections sufficient to affect significantly the distortionary cost estimates reported above? We contrast the estimated value of the distortionary cost in two dimensions. First, under the assumption of CRTS, we compute distortionary costs under the assumption of an exogenous wage premium, then under the assumption of an endogenously determined wage premium affected by union activity. Because of uncertainty about the relative weight unions attach to wages and employment, we report results for three combinations of weights to wages and employment in the utility function: low weight on wages ($\gamma = 0.2$, $\delta = 0.8$); medium ($\gamma = \delta = 0.5$); high weight on wages ($\gamma = 0.8$; $\delta = 0.2$). Second, we examine the sensitivity of these results on labor market imperfections to assumptions about market structure. Results for steel appear in table 3; results for autos in table 4.

Steel. Start with CRTS. The distortionary costs of rationing steel when the steel sector pays an exogenous wage premium of 26 percent is only about one-fourth of the cost when there is no wage premium. This derives from the second best effect of superior reallocation of labor. Given the high rent transfer component of VERs, however, the total costs are reduced by only 11 percent. The distortionary cost estimate reflects the potential lower cost of protection if an "equivalent" tariff (or a quota that captured rents) were employed rather than the VER.

Table 3
Effects of VERs in Steel
(billions of 1984 dollars)

	No Wage Distortion	Exogenous Wage Distortion	----Endogenous Wage Distortion <u>a/</u> ----		
			Union Wage Weight =.2	Union Wage Weight =.5	Union Wage Weight =.8
1. Distortionary Costs of VERs <u>b/</u>					
a. CRTS	0.128	0.033	0.036	0.069	0.113
b. Contestable Markets	0.038	-0.048	-0.046	-0.015	0.027
2. Capture Rents <u>b/</u>					
a. CRTS	0.736	0.735	0.740	0.803	0.879
b. Contestable Markets	0.716	0.715	0.721	0.784	0.862
3. Total Costs of VERs <u>b/</u>					
a. CRTS	0.864	0.768	0.776	0.872	0.992
b. Contestable Markets	0.754	0.667	0.675	0.769	0.889
4. Wage Distortion in Steel <u>c/</u>					
a. CRTS	0.0	.260	.263	.293	.330
b. Contestable Markets	0.0	.260	.263	.293	.331
5. Change Employment in Steel <u>d/</u>					
a. CRTS	20.8	20.8	20.2	13.7	5.9
b. Contestable Markets	18.9	18.8	18.3	12.5	5.4

Notes:

All simulations are with endogenous economywide labor supply.

a/ Weight on wages is given by γ and in all cases $\gamma + \delta = 1.0$.

b/ EV measure in billions of 1984 dollars. The distortionary cost is calculated as the difference between the total costs of VERs and the rents.

c/ Percentage wage distortions in steel.

d/ Change in employment in steel in thousands of work-years.

Table 4

Effects of VERs in Autos

(billions of 1984 dollars)

	No Wage Distortion	Exogenous Wage Distortion	-----Endogenous Wage Distortion <u>a/</u> -----		
			Union Wage Weight =.2	Union Wage Weight =.5	Union Wage Weight =.8
1. Distortionary Costs of VERs <u>b/</u>					
a. CRTS	1.95	1.78	1.79	1.84	1.88
b. Contestable Markets	0.91	0.82	0.85	0.98	1.08
c. Monopolistic Competition <u>c/</u>	1.63 (.952)	1.49 (.952)	1.48 (.954)	1.43 (.966)	1.38 (.977)
2. Capture Rents <u>b/</u>					
a. CRTS	7.87	7.88	7.88	7.87	7.87
b. Contestable Markets	7.87	7.88	7.88	7.87	7.87
c. Monopolistic Competition	7.89	7.88	7.88	7.88	7.89
3. Total Benefits of VER Removal <u>b/</u>					
a. CRTS	9.82	9.64	9.65	9.71	9.75
b. Contestable Markets	8.79	8.68	8.71	8.84	8.96
c. Monopolistic Competition	9.52	9.363	9.356	9.31	9.27
. Wage Premium <u>d/</u>					
a. CRTS	0.0	0.27	0.26	0.21	0.16
b. Contestable Markets	0.0	0.27	0.26	0.20	0.14
c. Monopolistic Competition	0.0	0.27	0.26	0.20	0.15
. Change in Employment <u>e/</u>					
a. CRTS	-36.2	-36.2	-33.9	-21.2	-8.7
b. Contestable Markets	-21.7	-21.7	-20.2	-12.5	-5.1
c. Monopolistic Competition	-19.5	-19.5	-18.3	-11.6	-4.9

Notes:

All simulations are with endogenous economywide labor supply.

a/ Weight on wages is given by γ and in all cases $\gamma + \delta = 1.0$.

b/ EV measure in billions of 1984 dollars. The distortionary cost is calculated as the difference between the total costs of VERs and the rents.

c/ The number in parentheses is the proportion of firms which remain in the industry after firm exit due to VER removal.

d/ Percentage wage distortions in autos.

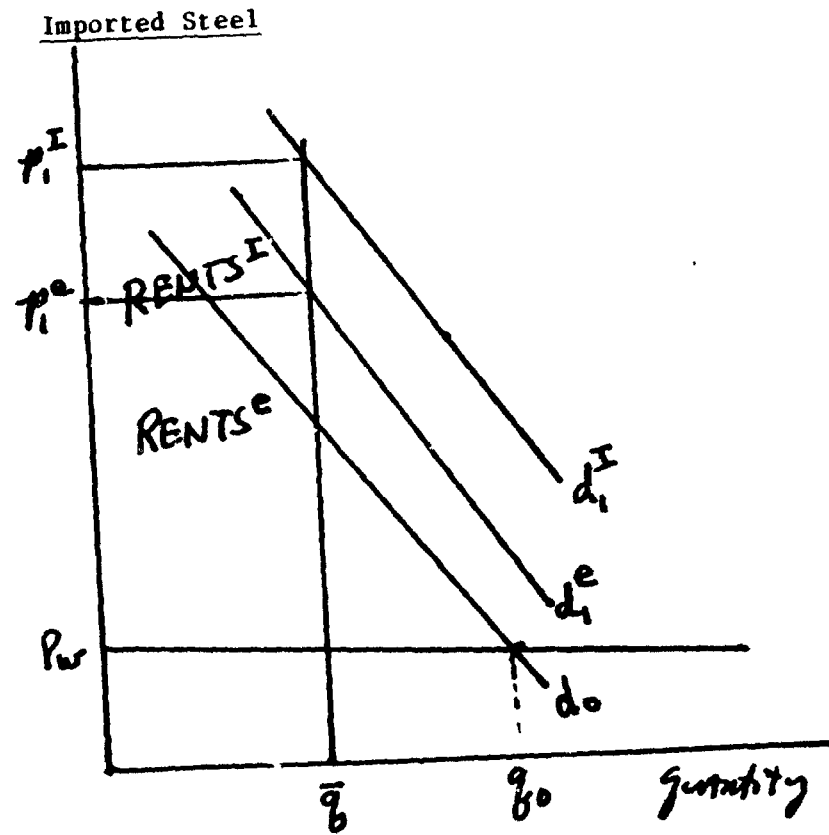
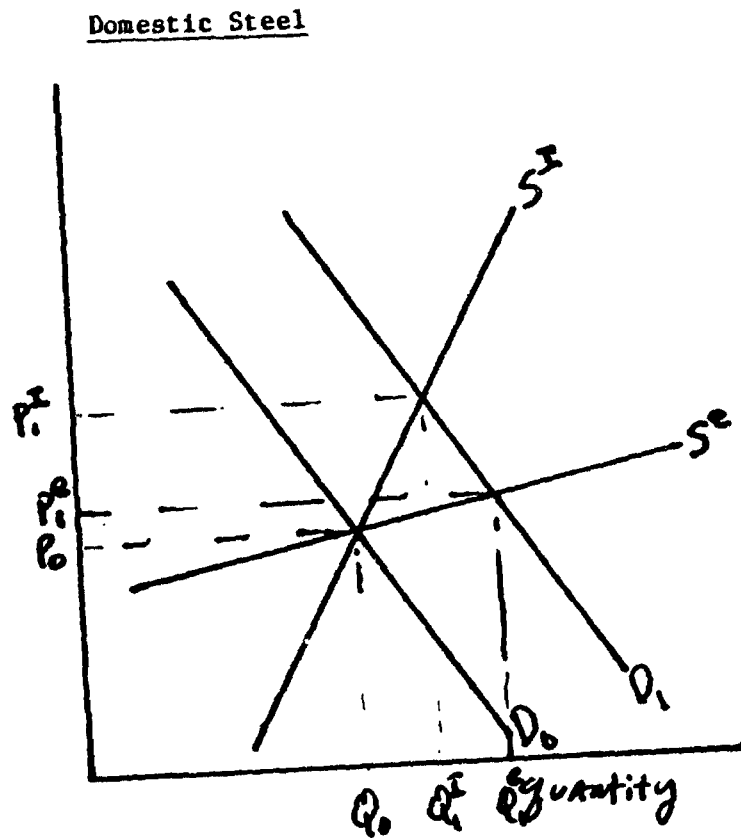
e/ Change in employment in autos in thousands of work-years.

Now consider the role of union activity. Labor demand being a derived demand schedule, protection displaces to the right the labor demand schedule. The more weight the union attaches to wages (and the less weight it attaches to employment) the larger the induced increase in wage premium and the lower the increase in employment. For the combination ($\gamma = 0.2$; $\delta = 0.8$), the wage premium barely increases and employment rises by almost as much as when the wage premium is exogenous. For the combination ($\gamma = 0.8$, $\delta = 0.2$), the wage premium reaches 33 percent and, as a result, there is only a small increase in employment of 5.9 thousand work-years. With a high weight on wages, the distortionary costs of protection are almost as high as in the absence of a wage premium. The increased wage premium raises distortion costs in the product market. This cost must be weighed against the improved allocation of labor. With a high weight on wages, the high wage premium and small labor reallocation results in an increase in product market distortions which almost exceeds the benefits of labor reallocation.

Note also that the rent costs of the VERs are sensitive to the weight the union places on wages (both under CRTS and contestable markets). This is because when VERs are imposed, there is an increase in demand for the domestic variety of the product which induces domestic firms to expand output. As firms expand output, however, they are faced with increased wage demands by the union. Thus, the greater the weight the union places on wages, the lower the elasticity of output supply of the domestic industry, and the higher the rent component cost of the VERs.

The impact of relatively inelastic domestic supply on rents is illustrated in figure 1, where the subscript 0 (1) indicates the initial (post VER imposition) equilibrium. Imports and domestic steel are gross substitutes for each other so that an increase in the price of domestic steel increases the

Figure 1
Impact of Domestic Supply Elasticity on VER Rents



Note: Superscript e (I) denotes elastic (inelastic) scenario.

demand for imported steel. When the VER is imposed on imported steel, the increased demand for the domestic variety results in a larger increase in the price of the domestic variety of steel the more inelastic is domestic supply. A larger domestic price increase, in turn, induces a larger increase in the price of the foreign variety of steel and a larger rent earned on foreign steel. Thus, as a result of the impact of the wage premium on the rent component of the VER, the total costs of protection under CRTS with a high weight on wages exceed the estimate in the case of no wage premium.

Now consider the effects of VER imposition in steel with contestable markets. VER imposition results in increased demand for domestic steel and consequently greater exploitation of economies of scale. The improvement in scale efficiency lowers significantly the distortion costs of protection. With exogenous wage distortions, the second best effects of superior labor reallocation are sufficient to result in efficiency gains (negative distortion costs) of \$45 million. It is only with the high weight on wages that the distortion costs become positive. Finally because the rent effect also depends on the wage distortion (see figure 1), the total costs of VERs exceed the corresponding estimate with no wage distortion when the weight on wages is high.

Autos. Here the estimates of rents are virtually invariant. This is because, unlike steel, auto VERs existed in the base year, so we remove VERs rather than impose them as in steel. Since all models are calibrated to be consistent with the exogenous estimates of the premia rates and rents that existed in autos in 1984, results differ only due to the distortion costs of the VERs.^{18/} Now because protection is removed, the reduction in the derived demand for labor induces a larger reduction in the wage rate the higher the union's weight on wages. This pattern holds across all market structures.

First consider CRTS and competition. Moving labor out of autos represents a second best loss, and consequently lowers the estimated value of the benefits of liberalization. As before, distortion costs increase as the weight on wages increases because there is less labor reallocation. Distortion costs remain high in all cases.

With contestable markets, removing protection results in a decrease in scale efficiency, and hence lower benefits of protection removal. Exogenous wage distortions have the anticipated second best effect. With endogenous wage distortions, distortion costs can exceed those in the no wage distortion case. As explained above, this is because the reduction in the derived demand for labor induces a lower wage demand by the union. The lower wage demand, in turn, induces an increase in output, which reduces distortions in the product market.

Finally, consider monopolistic competition. First, observe that the distortion costs exceed those under contestable markets in all cases. This is because with monopolistic competition there is exit in response to trade liberalization, so greater realization of scale efficiency is achieved than with contestable markets. Second, contrary to all other cases, the distortion costs of protection decrease, the greater the union's weight on wages. The reason is the following. The decrease in the derived demand for labor which accompanies trade liberalization induces a relatively large wage decrease (with high union weight on wages). This wage decrease lowers costs for firms which, in turn retards exit. The effect of lesser scale efficiency dominates the effect of the lesser loss from reduced labor misallocation, so that the benefits of liberalization are smaller with a high union weight on wages.

How robust are the results in tables 3 and 4? To assess how sensitive results are to changes in the key wage distortion parameter, we have replicated

all the simulations with a high and low estimate of the wage distortion, while leaving the value of all other parameters unchanged. For the high (low) simulations, we used Krueger and Summers' estimates of the wage distortion plus (minus) two times the standard error of their estimate of the wage distortion. After rounding, this yields wage distortion values of 33 and 19 percent in steel and 32 and 22 percent in autos. As expected, the second best effect of superior labor reallocation is increased (decreased) with higher (lower) assumed wage distortions. The change in the estimated welfare cost estimates with increased or decreased wage distortions is always less than \$35 million in both autos and steel. For example, with CRTS in autos and exogenous wage distortions, the estimated distortion costs increase (decrease) from \$1.78 billion to \$1.81 (\$1.75) in the high (low) wage distortion case. From tables 3 and 4, one can see that \$35 million is less than two percent of the distortionary costs of the auto VERs, and is also a small percentage of the total costs of the auto or steel VERs. Since the distortion costs of steel VERs are small or negative in some cases, an additional \$25-35 billion of benefits from superior labor reallocation in the high wage distortion case is important in percentage terms. We conclude that, overall, the striking result is that even with high wage distortions, the benefits of labor reallocation are small relative to the costs of protection.^{19/}

5. The Non-Optimality of "Optimal" Policies

We now ask what are the gains from removing the wage premia and give illustrative calculations of the potential benefits from applying "optimal" policies to counteract the distortions that arise from wage premia and/or market imperfections under IRTS. Start with the welfare gain of removing the

wage premia in autos and steel under the assumption that QRs remain in autos and steel. The gain from removing the wage premia in autos (steel) is \$0.18 (\$0.70) billion. The gain in steel is greater because the elasticity of labor demand is greater in steel than in autos. The wage distortion rates and number of employees are roughly the same in both sectors, but steel has a higher share of value added as wages and a higher elasticity of substitution of capital for labor.

Consider now the use of wage subsidies to achieve economies of scale and to counteract the effects of product market imperfections when there are IRTS in autos and steel. To isolate the effects of IRTS, all simulations start from a free trade undistorted equilibrium. The "optimal" policy then consists of choosing the wage subsidy rates in autos and steel which maximize utility of the representative consumer. We solve for these rates numerically. In the case where both industries use a contestable markets pricing rule, a welfare gain of \$1.045 billion would be achieved by wage subsidies of 5 percent in steel and 28 percent in autos. (The higher wage subsidy in autos reflects the higher cost-disadvantage ratio in that sector). If more realistically one assumes that the auto industry is characterized by monopolistic competition, exploitation of scale economies will be achieved by firm exit. Then the optimal wage policy is a wage tax of 56 percent which reduces by 5 percent the number of firms in the auto industry. Combined with the gains of a 5 percent wage subsidy in steel, the overall welfare gain would be \$367 million. Thus, the optimal wage policy for the auto industry with IRTS reverses from a subsidy to a tax on labor depending on the pricing rule. This is analogous to the Eaton-Grossman result mentioned above.

Consider next applying optimal tariff policy in the presence of wage distortions. As before, we start from an undistorted equilibrium, except that

now we include wage premia in autos and steel. The simulation exercise consists of maximizing utility using tariffs in autos and steel as instruments. As an illustration, we report the results of four sets of optimal tariff calculations: exogenous wage distortions with CRTS and IRTS, and endogenous wage distortions and high union weight on wages under CRTS and IRTS. In the case of CRTS, optimal tariff policy in both sectors with exogenous wage premia yields tariff rates of 5 (1) percent in steel (autos), for a total welfare gain of \$4 million. With endogenous wage premia, however, with a high weight on wages, the welfare gain is almost zero. The same pattern of lower benefits with endogenous wage distortions results if we assume IRTS with contestable markets in steel and monopolistic competition in autos. The corresponding magnitudes are \$145 million [with 10 (3) percent tariff rates in steel (autos)] with exogenous wage premia. With endogenous wage premia and high weight on wages the gains are reduced to \$7 million.20/

Due to strategic considerations, however, the gains from these optimal wage subsidy and tariff simulations may not be achievable. Wage subsidies to these industries to reduce distortions would be problematical if, as we have argued, wage distortions are the result of union activity. Unions would then find it to their advantage to increase wage demands resulting in increased government costs and taxation requirements with offsetting distortions. Similarly, the optimal tariff calculations are subject to the criticism that if the union believes that it can increase protection by its wage demands, then the benefits of optimal tariffs may not be achievable; and, of course, the optimal tariff would be significantly altered by retaliation.21/

Conclusions

At the outset of this paper we asked whether acknowledging that both autos and steel pay among the highest wage premia in US manufacturing would be sufficient to justify protection for these sectors based on wage premia. Through detailed modelling of the labor market and of its interactions with the product market, we have confirmed that the traditional costs of protection are mitigated by the presence of wage premia. If the wage premia can be considered exogenous, then the costs of protection will be lower than in the absence of wage premia, but not by much unless the wage premia interact with scale efficiency, and the latter is an important element of the product market structure. More importantly, we have argued that the more realistic representation of autos and steel is one in which unions set wages facing a tradeoff between employment and the wage premium. Then the existence of wage premia are likely to exacerbate the total costs of protection on two counts. First, if protection is by a VER, which is currently a frequent instrument of protection, then the rent loss component cost can be greater than if there is no wage premium. Second, if unions place a relatively high weight on wages, the distortionary costs of protection can be higher than if there were no wage premia. Our conclusion is that, generally, the evidence does not support the case for an industrial policy in high wage industries. We also asked what would be the benefits of "optimal" wage and tariff policy in both industries to counteract prevailing wage premia. With endogenous wage distortions, our calculations suggest extremely small welfare gains from optimal tariff policy if such policies could be implemented in practice. Depending on market structure, the optimal wage policy may be a tax.

Footnotes

- 1/ Several "efficiency wage" theories, based on differences in technology across industries, explain these wage premia. Shapiro and Stiglitz (1984) suggest that in industries where shirking is difficult or costly to detect, it may be efficient for firms to pay premium wages. Similarly, an industry which faces relatively high costs from labor turnover will find it optimal to pay premium wages (Stiglitz, 1985; Weiss, 1980). Akerlof (1984) argues that if the firm is perceived as earning rents, productivity may suffer if workers do not also receive rents. A particularly appealing theory is developed by Thaler (1989) who argues that it may be desirable in some industries to pay high (nondistortionary) wages to attract highly qualified workers in particular skill categories. As a result, productivity of workers in skill categories where premia are not desirable to the firm may decline, unless they also receive a premium which is distortionary.
- 2/ Katz and Summers are careful to point out that the case for an activist industrial policy must be tempered by the fact that it is unlikely to be applied optimally in practice. Also see section 5 below.
- 3/ As shown in section 4, this result applies in the case of CRTS or contestable markets, but is modified if one assumes a monopolistically competitive market structure for autos.
- 4/ In de Melo and Tarr (1990b), we show that although steel and auto workers in other countries earn a premium above the average manufacturing worker in their own countries, that premium is much greater in the US. Given our sample of 17 countries in the case of autos and 12 countries for steel, excluding the US, we find the average auto worker (steel worker) premium is 16 (33) percent.
- 5/ Since observed wage rates of homogenous labor differ across sectors, our calibration of the production function and the marginal productivity of labor is equivalent to measuring labor in efficiency units. We choose ϕ_i for autos and steel to be 1.27 and 1.26, respectively, rather than 1.53 and 1.63, which are wage premia unadjusted for productivity differences.
- 6/ For example, deregulation in the airline and trucking industries led to a considerable reduction in rents captured by the unions in these industries. See Kahn (1980) and Levinson (1980). More generally, Freeman and Katz (1987) have found enough variation in changes in wages across industries in response to demand to trace out a "trade-off" curve between wages and employment. They find that wages respond more to sales in unionized than in nonunionized industries.
- 7/ The union might accept a "low" wage in return for guarantees by the firm that it would employ more workers than given by its demand curve. But asymmetric information about product demand shifts (for which the firm must be permitted to adjust employment or it would not agree to the contract) will allow the firm to cheat on the agreement. Alternatively, an incentive-compatible contract which pays the union a lump-sum amount

independent of employment in return for a "low" wage will present problems for the union in terms of being able to allocate the lump-sum payments to its members.

- 8/ See Oswald (1982) for a formulation that includes leisure in the union's utility function.
- 9/ This is in contrast to Ballard et al. (1985) whose own elasticities were all unity and where cross-substitution effects between composite commodities are not allowed. In addition, our formulation allows labor supply (including the parameter MAXHOURS) to be written in terms of econometrically estimated elasticities rather than arbitrarily assuming a value for MAXHOURS. Ballard et al. (1985), who chose the latter approach, noted that their results were heavily dependent on assumed value for MAXHOURS, for which there is little data.
- 10/ Elasticity estimates draw on Pencavel (1986) and especially Abbott and Ashenfelter (1976) for males and Killingsworth (1983), Killingsworth and Heckman (1986) and especially Mroz (1987) for females.
- 11/ For steel we draw on Tarr (1984) and for autos on Winston and Associates (1987) and Friedlander, Winston and Wang (1983). The corresponding cost-disadvantage ratio (CDR) values are reported in table 1.
- 12/ A natural extension is to recognize that conjectures are themselves dependent on the number of firms. Sensitivity simulations with this extended formulation yield slightly larger benefits from trade liberalization but similar results for the pattern of wage distortions and are available from the authors on request.
- 13/ We assume there are three auto firms initially in calibrating conjectures. Given data on prices, costs and elasticities only the ratio of \tilde{N} to N is identified. Thus, an equivalent approach is to read in Cournot conjectures and calibrate for N , the Cournot equivalent number of firms. This is the approach followed by Dixit (1988) who obtains a value of $N = 13.8$ for 1983. Our calibration yields a value of $N = 4.2$, indicating a less competitive industry in 1984. An alternative -- but in our view less appealing -- approach is to solve for marginal costs or for the demand values for \tilde{N} , N and the zero profit condition. See Devarajan and Rodrik (1989) for another example along the lines followed by Dixit.
- 14/ The specification of foreign trade is as in de Melo and Robinson (1989). CES and CET formulations were developed by Armington (1969) and Powell and Gruen (1968). The assumption of product differentiation between domestic and export sales is of little consequence in view of the low export shares of the auto and steel industry. We choose the small country assumption. For an alternative large country formulation, see de Melo and Tarr (1990a).

- 15/ We have also estimated the case where US auto dealers of Japanese vehicles captured some rents above the premia rate of table 1. The costs of the VERs in this case exceed the estimates of table 2 by about \$1.3 billion (see de Melo and Tarr, 1990a).
- 16/ This implies that to obtain the joint costs of VERs in autos and steel one would remove the VERs from a solution where steel is rationed. Joint estimates are not reported here since the values are only very marginally less than the sum of the individual general equilibrium estimates.
- 17/ Sensitivity analysis to the assumed values of demand and supply elasticities with fixed labor supply are reported in de Melo and Tarr (1990a). As explained there, the rent component is sensitive to assumed elasticities only in the steel case. As to the distortionary cost component, when low (high) elasticities are used, the cost is \$1.09 billion (\$2.96 billion) for autos and \$0.27 billion (\$0.10 billion) for steel. The asymmetry with respect to variation in elasticities comes from the fact that quota imposition in steel results in a larger price change the lower the set of elasticities. Quota removal in autos, however, is necessarily treated as the removal of the tariff equivalent of the quota and results in a greater quantity change the greater the elasticities. See de Melo and Tarr (1990b).
- 18/ Estimates of the benefits of capturing rents differ very slightly due to the fact the estimates depend on the income elasticity of demand for autos which is endogenous.
- 19/ A similar pattern of results occurs when wage distortions are endogenous. A complete set of sensitivity results are in an appendix available from the authors on request.
- 20/ Our CRTS simulations are consistent with those of Dixit (1988). Dixit assumed CRTS and fixed input-output coefficients for labor and capital. He found a subsidy to the production of autos (which is equivalent to a wage subsidy with fixed coefficients) is a superior instrument to a tariff.
- 21/ See Fernandez (1989) for a discussion of other strategic issues that make the achievement of benefits from optimal policies in response to labor market distortions problematical.

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